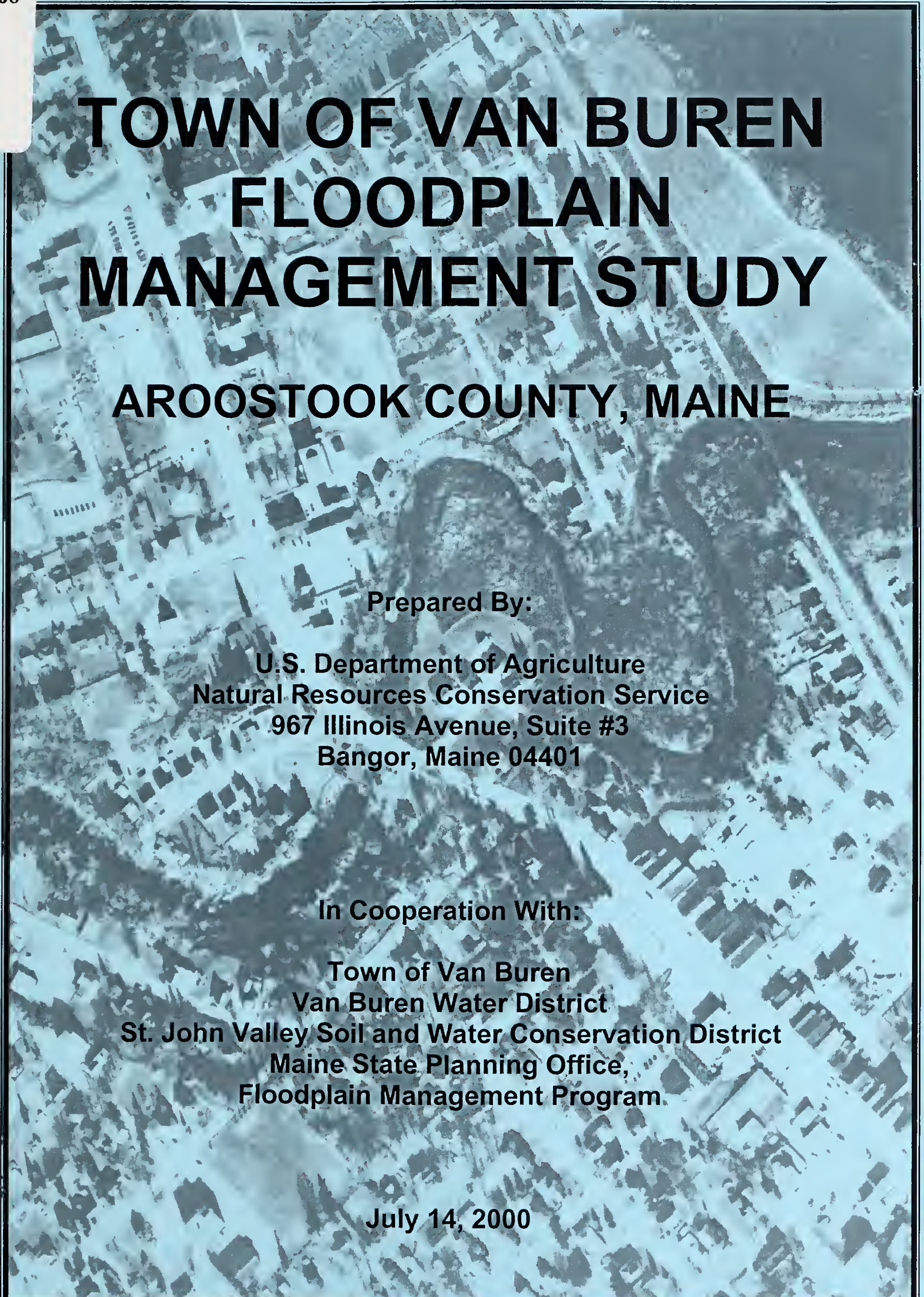

TOWN OF VAN BUREN FLOODPLAIN MANAGEMENT STUDY

AROOSTOOK COUNTY, MAINE

Prepared By:

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In Cooperation With:

Town of Van Buren
Van Buren Water District
St. John Valley Soil and Water Conservation District
Maine State Planning Office,
Floodplain Management Program

July 14, 2000

United States
Department of
Agriculture

National Agricultural Library

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- Federal Emergency Management Agency (FEMA), Boston, MA
- St. John Valley Soil and Water Conservation District (SJVSWCD), Fort Kent, ME
- Maine Department of Transportation (MDOT), Augusta, ME
- Maine State Planning Office, Floodplain Management Program, Augusta, ME
- National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), Asheville, NC
- Town of Van Buren, ME
- Van Buren Water District, Van Buren, ME
- United States Army Corps of Engineers (USACE), Concord, MA
- United States Geological Survey (USGS), Augusta, ME

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TOWN OF VAN BUREN
FLOODPLAIN MANAGEMENT STUDY
AROOSTOOK COUNTY, MAINE

INTRODUCTION

This Floodplain Management Study (FPMS) report presents floodplain information for Violette Stream and Violette Brook within the Town of Van Buren, Maine. Data generated consists of a flood hazard evaluation, including floodplain maps and flood profiles, and options for floodplain management.

Technical information and recommendations provided in this report will be useful to the Town in development of its comprehensive plan, identifying floodplain areas, as a guide for developing or improving a floodplain management program for the areas studied, and to update the Town's codes and zoning ordinances. The data generated from this study also will be useful to local, state, and Federal agencies, planning groups, engineers, consultants, and others involved in community planning and the design of hydraulic structures, channels, roads, bridges, culverts, and other community facilities.

This report will facilitate more effective and consistent administration of the community's floodplain management ordinance. Such regulations are needed to minimize loss of life and property damage from future floods, prevent degradation of the watershed's environmental resources, and ensure orderly community growth in areas suitable for development. The report also provides information needed to comply with Maine's 'Mandatory Zoning and Subdivision Control Law', which applies to shoreland areas.

NRCS conducted this study in response to a request by the Town of Van Buren and the Van Buren Water District to the St. John Valley Soil and Water Conservation District (SJVSWCD). The Van Buren Water District submitted a formal application for Federal assistance in developing a FPMS to the Maine State Planning Office, Floodplain Management Program, which establishes study priorities throughout Maine.

NRCS carries out these studies under provisions of Section 6 of Public Law 83-566, the Watershed Protection and Flood Prevention Act of 1954, as amended. Participants cooperated in developing a Plan of Work (POW) dated March 1998.

STUDY AREA

The Town of Van Buren is a small, rural community located along the St. John River in northeastern Maine. It is situated 35 miles north of the City of Presque Isle, Maine (see Figure 1, Location and Study Area Map). U.S. Routes 1 and 1A, major links between northern Maine and points south, pass through the Town of Van Buren. Van Buren is also a major border crossing point between the United States and Canada. The 1990 U.S. Census indicates the town has a resident population of 3,045.

The total land area of the town is approximately 33.2 square miles. Land use is 55 percent forestland, 40 percent is open land including agriculture, and 5 percent is urban and residential.

Van Buren is located entirely within the St. John River watershed. Violette Stream is a sub-basin of the St. John River. The NRCS Hydrologic Unit Code for the study area is 010010001280.

The Town's topography consists mostly of rolling hills with fairly broad floodplains in the valleys along Violette Stream, and the St. John River. Elevation extremes are approximately 1,100 feet near the Cyr Plantation town line in southwestern Van Buren, to about 425 feet where the St. John River crosses the Van Buren - Hamlin town line.

Van Buren's economy is closely tied to retailing, farming, manufacturing, and the forest products industry.

The soils in the Town of Van Buren have been mapped by the NRCS and a soil survey report has been published. Interested individuals may obtain soils information by visiting, writing, or calling the following NRCS field office:

USDA, Natural Resources Conservation Service
Fort Kent Service Center
96 Market Street
Fort Kent, Maine 04743-1425
Telephone (207) 843-3311.

The Van Buren area receives a mean annual precipitation of 37 inches, which includes the water equivalent of 89 inches of snow. The precipitation is distributed evenly throughout the year; however, snowmelt accounts for a large part of the runoff. The mean annual temperature is approximately 37.4 degrees Fahrenheit (^{o}F). Monthly mean temperatures range from a low of 5.9^{o}F in January to a high of 64.8^{o}F in July.

NRCS studied the following streams within the community in detail (see Figure 1, Location and Study Area Map):

- Violette Stream - upstream from its confluence with the St. John River about 2.3 miles to Champlain Street; drainage area 65.1 square miles.

- Violette Brook - for its entire length within the community, about 3.3 miles from its confluence with Violette Stream to the Cyr Plantation town line; drainage area 13.6 square miles.

Development is heaviest in and around downtown Van Buren, and along U.S. Routes 1 and 1A. Within the floodplains studied development consists of single family homes, recreational properties, farmland, a park, roads, and bridges. The demand for land suitable for development has increased in recent years, resulting in additional pressures to develop floodplain property.

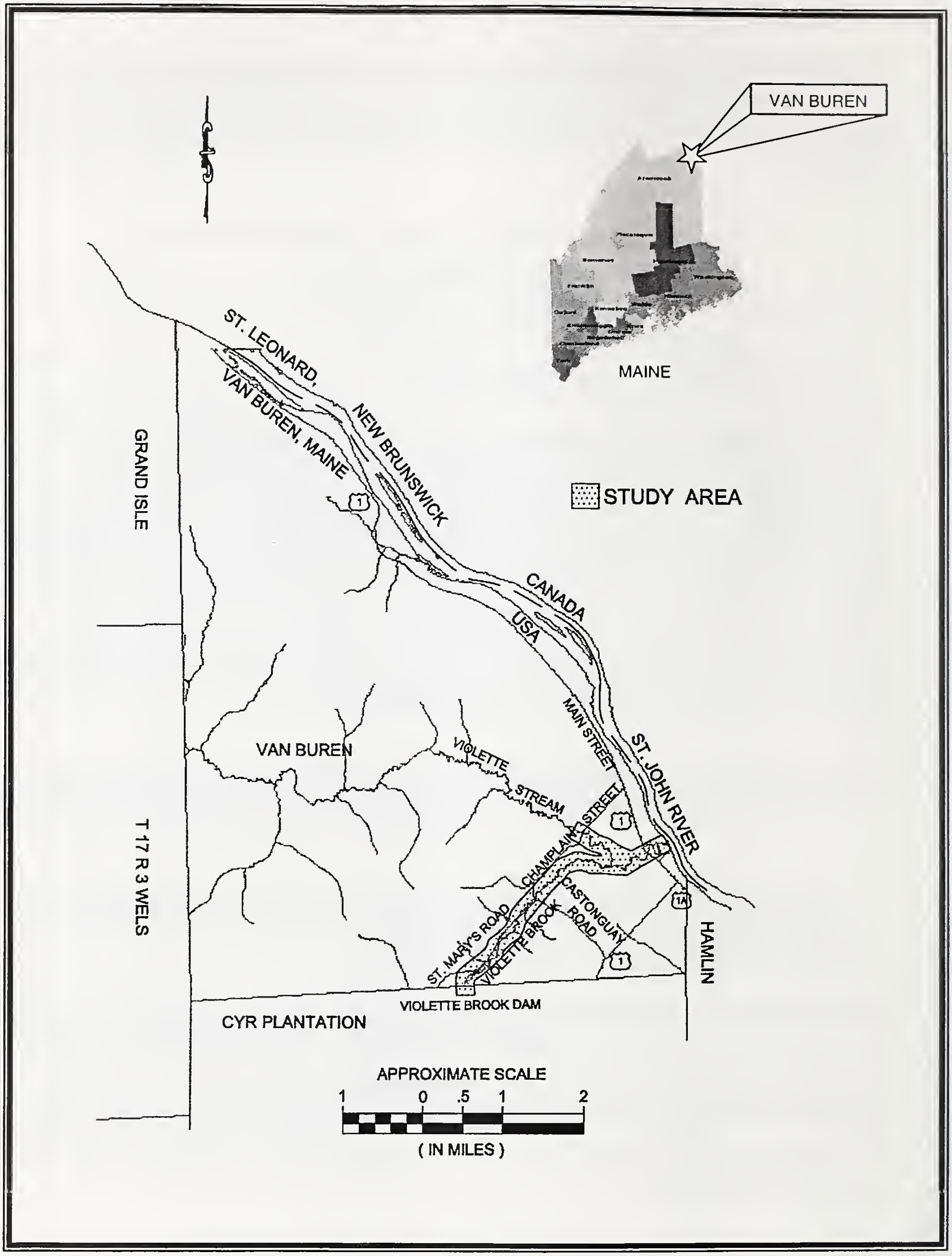


Figure 1 -- Location and Study Area Map
Van Buren, Maine

Violette Stream, a tributary flowing easterly to the St. John River, has a length of 10.8 miles and a drainage area of 65.1 square miles at its confluence with the St. John River in Van Buren.

Violette Brook, a tributary flowing northeasterly to Violette Stream, has a length of 7.0 miles and a drainage area of 13.6 square miles at its confluence with Violette Stream in Van Buren.

There are nine bridges and culverts on the streams studied in Van Buren. These include four on Violette Stream, and six on Violette Brook (see Table 4, Bridge and Culvert Data, for further information).

Historically, there have been a number of dams located on the streams studied in Van Buren. Only one remains:

- a deteriorated rock filled timber crib dam on Violette Brook known as the Lower Reservoir Dam.

Natural Values

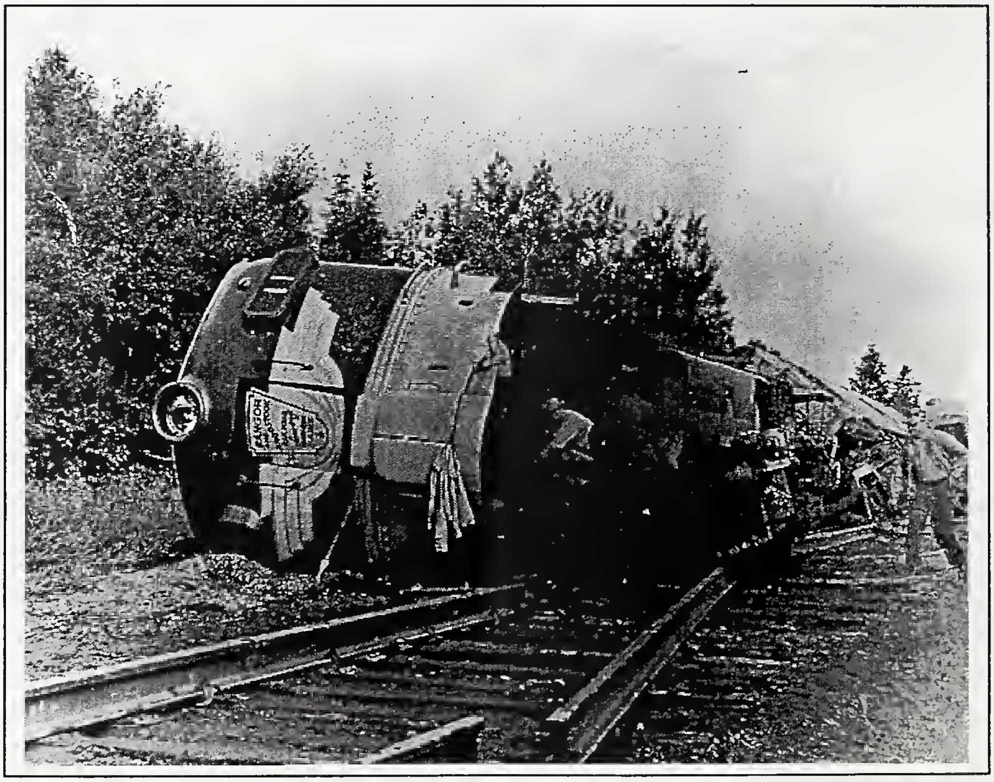
Today's uses of the streams in Van Buren are primarily recreational and include such activities as: open water fishing, and swimming.

Other popular activities in the area are small and big game hunting, cross-country skiing, bicycling, canoeing, snowmobiling, picnicking, hiking, fall foliage touring, camping, photography, and nature study. The watersheds of the streams studied support a wide variety of wildlife, birds, and fish, and provide a source of water for homes, businesses, agriculture, and fire protection.

Flood Problems

Van Buren's flood history indicates that damages can occur at any time during the year, but particularly in the winter and early spring months following heavy rainfall on snow-covered or frozen ground; in summer following intense thunderstorms; and in summer and fall during tropical hurricanes.

The most destructive flood, in the Violette Stream Watershed, is considered to be that of September 1954. Other floods are known to have occurred in 1923, 1936, 1958, and 1962. Damage caused by those floods and others has been to single family residences, recreational property, farmland, utilities, roads, and bridges. Stream bank erosion is also a problem during flood events.



Bangor and Aroostook Railroad Train
Derailed During the Flood of September 1954.

Tables 1 and 2 summarize the approximate extent of flooding caused by the 100-, and 500-year events to structures and floodplain land.

Table 1 -- APPROXIMATE NUMBER OF STRUCTURES IN FLOODPLAINS STUDIED

STRUCTURE TYPE	100-YR.	500-YR.
RESIDENTIAL	11	14
OTHER	5	12
TOTAL	16	26

Table 2 -- APPROXIMATE FLOODPLAIN AREAS (ACRES) [1]

LOCATION / LAND USE	100-YR.	500-YR.
VIOLETTE STREAM		
Openland	5	6
Forest	22	30
Wetlands	33	36
Urban	5	13
VIOLETTE BROOK		
Openland	1	3
Forest	28	36
Wetlands	23	24
Urban	1	2
TOTAL	118	150

[1] *Classified by apparent primary land use. Does not include normal stream area. Urban areas include commercial, municipal, residential, and recreational properties, and roads and bridges.*

ENGINEERING METHODS

For the flooding sources studied in Van Buren, NRCS used standard hydrologic and hydraulic study methods to determine the elevation and areal extent of floods. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) were selected as having special significance for floodplain management in the town. The common terms for these floods are the 10-, 50-, 100-, and 500-year frequency floods. Although this frequency designation does represent the long term average time between floods of a specific magnitude, floods do not occur at regular, predictable intervals. The more correct terms for these floods are the 10-, 2-, 1-, and 0.2-percent chance flood events, but this report generally will use the long-established and widely recognized 'frequency' designation.

Rare floods could occur at short intervals or even within the same year. When one considers periods greater than 1 year, the risk or probability of experiencing a rare flood increases. For example, the probability of having a flood that equals or exceeds the 1-percent chance (100-year) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10.) The analyses reported herein reflect flooding potentials existing at the completion of field surveys for the study.

Hydrologic Analyses

NRCS conducted detailed hydrologic analyses to establish the peak discharge-frequency relationships for each flooding source affecting the community. There are no stream gaging stations within the watershed studied, and no meaningful surface water flow records exist.

Routine manual or computer-aided computations for subwatershed times of concentration and flood routing reach lengths were made with the aid of 7.5' topographic maps. NRCS developed composite runoff curve numbers based on existing land use.

NRCS used the Technical Release Number 20 (TR-20) hydrologic evaluation model (USDA, SCS, 1983) to compute discharges on each stream studied in Van Buren. TR-20 is the designation for a watershed computer model entitled Computer Program for Project Formulation – Hydrology. The program is a physically based event model that computes direct runoff resulting from any synthetic or natural rainstorm. It takes into account conditions having a bearing on runoff, develops a hydrograph, and routes the flow through stream channels, reservoirs, and natural storage areas. It combines routed hydrographs with those from other tributaries. The program includes provisions for hydrograph separation by branching or diversion of flow and the addition of baseflow. There is no provision for recovery of initial abstraction or infiltration during periods of no rainfall during an event. TR-20 does not have a groundwater component.

The program can compute peak discharges, their times of occurrence, volumes of runoff, water surface elevations, and duration of flows at any desired cross section or structure. It conducts detailed hydrologic analyses to establish the peak discharge-frequency relationships for each flooding source studied.

The TR-20 model used historical rainfall data for all evaluated frequencies. Modeled storms had a 24-hour duration and an NRCS Type I rainfall distribution.

Table 3, Summary of Discharges, shows a summary of the relationships of drainage area to peak discharge for each stream studied in Van Buren.

Table 3 -- SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (MI.^{2})	PEAK DISCHARGES (CFS)			
		10-YR.	50-YR.	100-YR.	500-YR.
VIOLETTE STREAM					
Bangor and Aroostook R.R.	65.1	3,740	5,885	6,950	9,525
U.S. Route 1, Main Street	65.0	3,735	5,880	6,940	9,520
Champlain Street	50.7	3,125	5,155	6,160	8,600
VIOLETTE BROOK					
Old Railroad Grade	13.5	625	885	1,020	1,290
Castonguay Road	12.8	585	775	875	1,065
Private Road	12.6	575	750	840	1,015
St. Mary's Road	12.4	560	715	795	945
Private Road	10.7	465	505	525	565

The hydraulic analyses for this study assumed that flow was unobstructed. The analyses did not consider the effect of ice jams. The flood elevations shown on the profiles are thus valid only if hydraulic structures remain unobstructed, and do not fail.

The reference for all elevations is the National Geodetic Vertical Datum of 1929 (NGVD). Flood Hazard Area Maps show the locations of elevation reference marks used in this study. Table 5, Elevation Reference Marks, contains reference mark descriptions.

Hydraulic Analyses and Floodplain Delineation

Detailed hydraulic studies were conducted to provide estimates of the elevations of floods of the selected recurrence intervals on each stream studied in Van Buren. NRCS's Computer Program for Water Surface Profiles (WSP2), (USDA, SCS, 1993) provided information on elevation, discharge, flow area, and flooded area at specified locations along stream valleys. The program can compute up to 15 water surface profiles in one pass through the watershed. It uses the standard step method, with some modifications, to compute profiles between valley cross-sections. At a road crossing, it calculates head loss through a bridge opening, culverts, or a combination of them. It can compute flow profiles for subcritical and critical flow. The TR-20 program uses valley cross-section hydraulic ratings and structure ratings generated by WSP2 to reach-route flood hydrographs through valley reaches and reservoir route through storage areas.

NRCS conducted field surveys to obtain cross section data for all streams studied in Van Buren. Crews surveyed all bridges, dams, and culverts to obtain elevation data and structural geometry (see Table 4, Bridge and Culvert Data).

The Flood Profiles and Flood Hazard Area Maps show the locations of selected cross sections used in the hydraulic analyses.

Table 4- BRIDGE AND CULVERT DATA [1]

LOCATION	CHANNEL BOTTOM ELEV.	LOW CHORD ELEV.	ROAD OVERFLOW ELEV.	FLOOD ELEVATIONS 10-YR.	50-YR.	100-YR.	500-YR.
VIOLETTE STREAM							
Bangor and Aroostook R.R.	420.9	454.8	461.1			452.0[2]	
U.S. Route 1, Main Street	430.6	444.0	462.7	446.8	454.8	460.6	465.6
Snowmobile/ATV Trail	465.8	469.7	470.1	473.5	474.7	475.1	476.2
Champlain Street	467.6	480.6	482.1	480.3	482.3	483.5	484.7
VIOLETTE BROOK							
Old Railroad Grade	472.5	482.4	482.0	477.9	478.4	478.6	479.1
Castonguay Road	522.4	531.4	531.0	528.8	530.2	530.8	531.8
Private Road	531.0	537.1	536.6	537.2	537.9	537.9	537.9
St. Mary's Road	535.0	542.0	539.8	541.6	542.2	542.4	542.7
Private Road	583.5	589.5	588.4	589.2	589.5	589.6	589.8

1 Elevations in feet NGVD, at upstream end of bridge or culvert opening.
2 Backwater from St. John River (Elevations of 10-,50-,and 500-Year floods not determined).

Table 5 - ELEVATION REFERENCE MARKS (RM)		
RM #	ELEV. [1]	DESCRIPTION OF LOCATION
RM 1	482.85	Chiseled square, painted orange, on top of the north end of the north concrete abutment of the Bangor and Aroostook Railroad bridge over Violette Stream.
RM 2	454.64	Chiseled square, painted orange, on top of the northwest corner of the north end of the west concrete headwall of the U.S. Route 1 (Main Street) bridge over Violette Stream.
RM 3	484.363	USGS standard tablet, stamped "3 JWM 1952", on top of the north end of the east concrete abutment of the Champlain Street bridge over Violette Stream.
RM 4	483.12	Top of 1¼ inch bolt, painted orange, at the east end of the north abutment of the abandoned Bangor and Aroostook Railroad bridge over Violette Brook.
RM 5	531.42	Stamped "61", painted orange, on top of the upstream end of the 9' by 25' structural plate pipe arch culvert at the Castonguay Road crossing of Violette Brook.
RM 6	538.22	Horizontal nail in steel disk, set in the base of NYNEX pole # 13, at the St. Mary's Road crossing of Violette Brook, in the west face of the pole, 25 feet northwest of the centerline of St. Mary's Road, 40' west of Roy driveway, and approximately 1 foot above ground level.
RM 7	598.55	Horizontal nail in steel disk, set in the base the northernmost of two utility poles, 550 feet west along the access road to Violette Brook Dam from its intersection with St. Mary's Road, near Omer LeBel cottage, in the east face of the pole, 28 feet south of the centerline of the access road, and 1.3 feet above ground level,.
RM 8	620.490	Cyr Plantation, USGS standard tablet, stamped "TT1 MC 1927, Reset 1973", on top of the northeast end of the northwest concrete wall of the outlet structure of the Violette Brook Dam on Violette Brook.

[1] *National Geodetic Vertical Datum of 1929.*

The boundaries of the 100-, and 500-year floods shown on the Flood Hazard Area Maps were delineated from elevations determined at each cross section. Between cross sections, the flood boundaries were interpolated using topographic maps at a scale of 1:24,000 and contour interval of 20 feet, and aerial photography. Field survey information, engineering computations, and other data pertinent to the study are on file and available for review at the following location:

USDA, Natural Resources Conservation Service
967 Illinois Avenue, Suite #3
Bangor, Maine 04401
Telephone (207) 990-9100.

FLOODPLAIN MANAGEMENT

The watershed topography dictates to a large extent the flood problems that occur in Van Buren. Natural drainageways on the hills form numerous tributaries to the streams studied. The steepness of their watersheds produces very quick flood peaks.

Natural channels draining the uplands erode and become deeper due to steep channel gradients and high velocities. Flatter gradients and lower velocities in the valleys deposit the eroded materials in the channel. As a result of the erosion and deposition process, and debris and ice jams, valley channels tend to fill in and become wider.

Historically, transportation systems tend to follow streams and rivers because of ease of access and construction. Towns develop along streams at sites where major roads converge. The transportation system and towns are subject to flood damage when they lie within the floodplain. Development in outlying areas usually occurs along existing roads. This is the case in the Town of Van Buren.

Flood Damages

The streams studied in Van Buren have experienced flooding on numerous occasions. Flooding occurs at least annually and sometimes two or three times per year. Flooding usually occurs during heavy rains in winter and spring. Ice and debris jams further compound the problem.

Damage in the study areas is primarily to homes, farmland, roads, bridges, and recreational properties.

Flood damages consist of two main types:

- losses resulting from direct contact with flood water; and

- losses resulting from people being isolated due to the flooding of roads.

Damages resulting from direct contact with flood water include residential, agricultural, and road damages. Residential damage consists of flood water and deposition on the first floor and incidental damage to lawns and out buildings. Table 1 shows the approximate number of buildings within the floodplain. All houses in the floodplain are in low hazard areas as defined by FEMA (see Glossary for definition of high hazard area). Agricultural damage consists of streambank erosion, deposition of sediment and debris on fields, and fence damage. Damages to state and town roads consist of debris and ice jam deposition, scour holes in the pavement, and washed out fill and culverts.

The single road access to several homes along Violette Brook has the potential of isolating several families during a flood. Included in this group might be infants, elderly, and people with medical problems. The safety and health of these people may be in jeopardy because fire protection, medical, and essential services, such as public utilities and oil deliveries may not be available until the floodwater recedes.

Floodplain Management Options

The management options that follow provide general information on the various means of flood protection and the reduction of monetary loss caused by floods. These options fall into two major categories: nonstructural and structural. Not all options will apply in Van Buren. With further study, the Town or individuals may find viable options to reduce flood losses. Considerations in this evaluation include:

- whether the area is in a high or low hazard area;
- engineering feasibility;
- economics;
- effect on flooding elsewhere (induced flood damages); and
- social acceptability.

Nonstructural Measures

Nonstructural measures cannot prevent flooding, but they can help reduce future problems and monetary loss. The implementation of nonstructural measures should have little to no effect on the environment.

1. Floodproofing

Floodproofing is any measure that property owners may take to minimize flood damage to their property. The following are some of the more common means used to floodproof buildings:

- elevating the building above expected flood levels;
- application of waterproof sealant to foundations and permanent closing and sealing of lower openings;
- construction of earthen dikes or masonry floodwalls around the building to prevent water from entering it;
- installing water tight closures that can be quickly and easily placed over doors and windows;
- protection of appliances and utilities, such as furnaces, washers, dryers, and electrical and plumbing systems. Elevate the appliance or place it in a water proof bag to protect it from rising flood water.

Several buildings in Van Buren could benefit from floodproofing. Property owners should consider the following when selecting the most appropriate measure or combination of measures:

- the depth, velocity, and duration of flood flows;
- the benefit-to-cost ratio of the measure;
- engineering feasibility;
- soil types; and
- local codes and building restrictions.

The Federal Emergency Management Agency's (FEMA) publication, Design Manual for Retrofitting Flood-prone Structures, FEMA 114, 1986 contains additional information on floodproofing. Interested parties can order the publication at no cost by writing to the following address:

Federal Emergency Management Agency
P.O. Box 70274
Washington, DC 20024
Attn: Publications.

2. Purchase or Relocation

In areas where all other means of flood protection are ineffective or impractical, federal and state funds may be available to buy properties or relocate buildings and their occupants. After removal of the buildings, use the land for recreation or some other purpose not significantly affected by floodwater.

This option applies to existing houses in the floodplain. This approach is most desirable from a floodplain management perspective, but it may not be socially acceptable.

3. Land Use Regulation

Use this option to keep future development out of the floodplain. The Town can acquire conservation, scenic, or flood control restrictions or easements in flood hazard areas where little or no development is desirable. Land use restrictions prevent development that is incompatible with public objectives, while allowing continued private ownership of the land. Certain future land rights, such as construction of buildings in the floodplain, could be purchased from present landowners. Permitted uses could be farming, wildlife, low intensity recreation, and woodland. Land use restrictions may also result in a lowering of the landowner's tax assessment.

In 1971 the State of Maine enacted the Mandatory Zoning and Subdivision Control Law, Chapter 424, Sections 4811 through 4814 of the Maine Statutes. The law requires all municipal units of government to adopt zoning and subdivision control ordinances for shoreland areas. Shoreland areas include land within 250 feet of the normal high water mark of any pond, river, or salt water body. This includes a major portion of the floodplain.

The Town has zoned the flood prone area to prevent future development.

The Town should consider the preparation of an overall land use plan to enhance the natural and recreational values of the areas studied in Van Buren. The plan would set integrated objectives for public access, historic sites, recreational facilities, and the preservation of significant wildlife habitat areas.

Other general recommendations include:

- maintain wetland and floodplain vegetation buffers to reduce sedimentation and delivery of chemicals to the water body;

- support agricultural and forestry practices that minimize nutrient flows into water bodies;

- support proper use of pesticides and fertilizer;

- minimize soil erosion on land within, or adjacent to, floodplains, on forest road systems, and at timber harvesting operations; and

- dispose of spoil and waste material in a manner that would not contaminate ground and surface water or significantly change land contours.

Additional technical information on voluntary natural resource protection measures is available from the local SJVSWCD office at 96 Market Street in Fort Kent, telephone (207) 834-3311.

4. Flood Insurance

Van Buren has been a participant in the ‘regular’ phase of the National Flood Insurance Program (NFIP) since 1986. This program enables existing home owners within the 100-year floodplain to buy up to $245,000 worth of flood insurance on their home and contents at subsidized rates. Up to $550,000 worth of insurance can be obtained for multifamily homes and small businesses.

As part of the program, the Town must require a building permit for all proposed construction within flood-prone areas and review the permit to ensure that the site is reasonably free from flooding. It also must require that structures in flood-prone areas be properly anchored and that recommended construction materials and methods be used to minimize flood damage.

Home owners in flood prone areas should protect themselves from monetary loss with flood insurance. The Town should ensure that property owners in or next to the floodplain are aware of the availability of Federally subsidized flood insurance under the NFIP. Policies and information on coverage and rates are available from most insurance agents.

5. Floodways

Any encroachment in the floodplain will reduce its flood carrying capacity. Examples of encroachment include the placement of earthfill and the construction of buildings in the floodplain. The reduced capacity caused by the encroachment results in increased velocities and flood heights. Flood hazards, both upstream and downstream of the encroachment itself, generally increase.

One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood damages. Under this concept, the 100-year floodplain is divided into a floodway and a floodway fringe.

The floodway is the main channel of the watercourse plus any adjacent floodplain areas that must be clear to pass the 100-year flood without substantial increases in flood heights. FEMA minimum standards limit such increases in flood heights to 1.0 foot, provided that hazardous velocities do not result.

The floodway fringe includes the remainder of the floodplain that can be obstructed without increasing the 100-year flood elevation by more than 1.0 foot. This approach allows some development while protecting the existing floodplain. Typical relationships between the floodway the floodway fringe and their significance to floodplain management are shown in Figure 2.

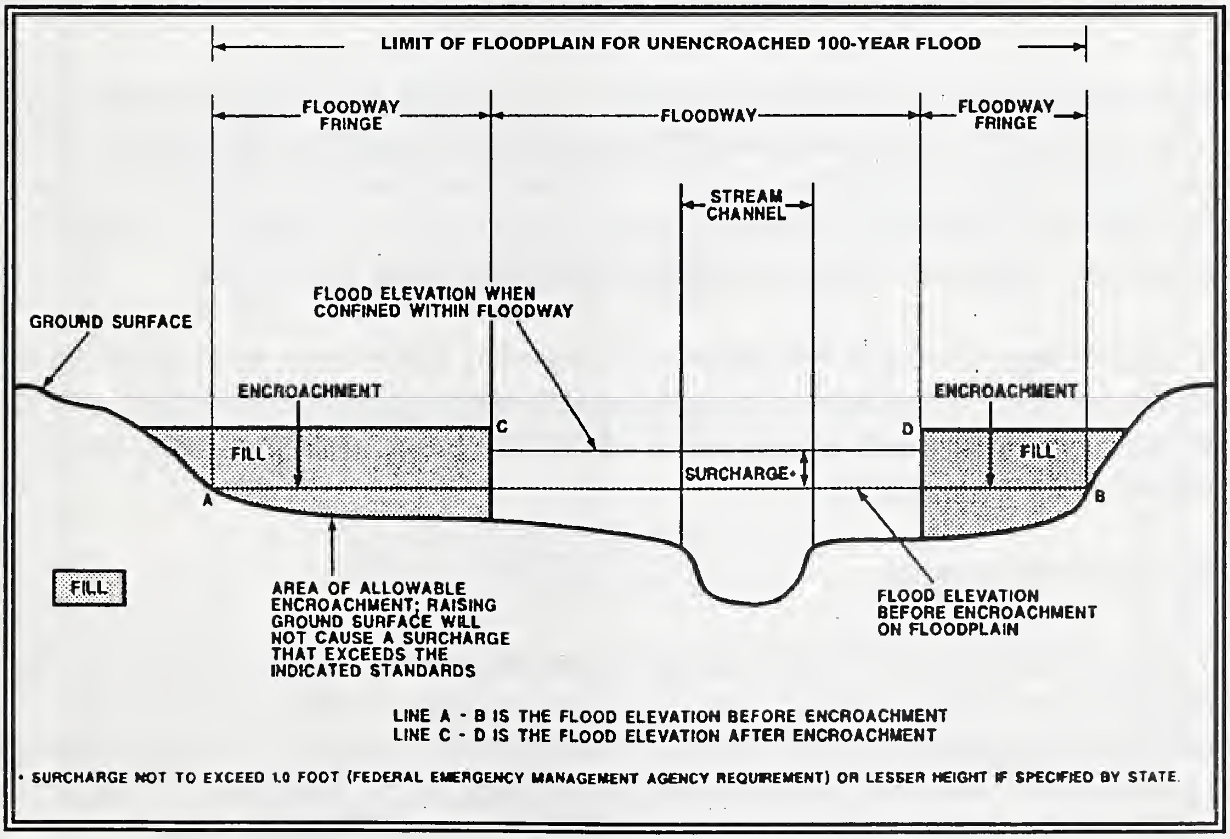


Figure 2 – Floodway Schematic

NRCS computed theoretical floodways for each of the streams studied in Van Buren considering equal flow reduction from each side of the floodplain. Floodway widths were computed at each cross section. Between cross sections, the floodway boundaries were interpolated. The computed floodways are shown on the Flood Hazard Area Maps (Appendix A). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. Floodway data for selected cross sections is presented in Table 6, Floodway Data.

6. Warning Signs and Flood Markers

One proven method of discouraging floodplain development is to erect flood warning signs or markers in floodprone areas or to prominently post previous or predicted flood levels. This is a viable option for some stream crossings in Van Buren. These markers carry no enforcement, but simply serve to inform the public that a significant flood hazard exists.

7. Flood Warning and Response Systems

Flood warning and response systems use rainfall and channel water level information from upstream areas to predict flood stages downstream and provide early warning of a flood. This provides time for residents in the floodplain and emergency management agencies to evacuate people, animals, and belongings and otherwise prepare for the flood.

The drainage areas of the streams studied in Van Buren are too small and steep for such a system to provide timely warning of flood danger. In other words, the flood peak would occur about the same time as the system would sound the alarm.

8. Existing Roads

Table 4, Bridge and Culvert Data, shows the effects of flooding on bridges and culverts. Any planned road, culvert, or bridge work must involve detailed modeling of flood flows to determine the effects of flood heights on planned improvements and existing buildings in the floodplain. Raising roads may induce higher flood heights on buildings located next to the road.

Table 6 - FLOODWAY DATA

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	SECTION WIDTH (FEET)	AREA (SQ FT)	MEAN VELOCITY (FPS)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
VIOLETTE STREAM								
A	640	136	1,208	7.6	452.0	437.4[2]	437.4	0.0
B	2,983	57	803	8.7	452.0	443.0[2]	443.7	0.7
C	3,343	84	1,922	4.4	460.6	460.6	460.6	0.0
D	3,948	90	1,317	6.3	461.1	461.1	461.2	0.1
E	5,030	335	3,338	2.6	467.2	467.2	467.7	0.5
F	5,760	597	4,289	1.8	467.5	467.5	468.1	0.6
G	7,720	231	1,596	4.9	470.1	470.1	470.8	0.7
H	8,360	159	1,137	6.4	472.1	472.1	472.9	0.8
I	10,125	404	2,259	3.5	475.1	475.1	476.1	1.0
J	11,010	123	1,058	6.3	477.5	477.5	478.3	0.8
K	11,520	431	3,778	2.3	483.5	483.5	483.7	0.2
L	12,100	362	3,308	2.8	483.7	483.7	483.9	0.2

[1]Feet above confluence with St. John River.
[2]Elevation computed without consideration of backwater effects of St. John River.

Table 6 - FLOODWAY DATA

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	SECTION WIDTH (FEET)	AREA (SQ FT)	MEAN VELOCITY (FPS)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
VIOLETTE BROOK								
A	250	30	157	6.8	468.3	466.3[2]	467.2	0.9
B	1,125	109	240	6.1	473.7	473.7	474.5	0.8
C	1,245	125	344	3.7	474.6	474.6	475.6	1.0
D	1,965	92	313	3.6	478.1	478.1	478.9	0.8
E	2,230	30	152	6.7	479.2	479.2	480.0	0.8
F	2,510	74	250	4.9	481.3	481.3	482.1	0.8
G	3,135	40	224	4.5	484.4	484.4	485.1	0.7
H	3,620	82	243	4.9	489.2	489.2	490.0	0.8
I	4,738	89	234	5.4	500.2	500.2	501.1	0.9
J	6,723	61	212	5.3	517.6	517.6	518.6	1.0
K	7,692	53	170	6.4	527.4	527.4	528.0	0.6
L	8,152	54	315	2.8	531.0	531.0	531.4	0.4
M	8,442	25	130	6.6	532.9	532.9	533.8	0.9
N	9,004	41	164	5.6	538.2	538.2	538.5	0.3
O	9,280	33	136	6.3	540.0	540.0	540.7	0.7
P	9,493	24	126	6.3	541.4	541.4	542.3	0.9
Q	9,673	27	142	6.2	542.6	542.6	543.6	1.0
R	9,803	36	155	5.3	543.3	543.3	544.2	0.9
S	12,775	66	442	1.8	572.6	572.6	572.7	0.1
T	14.907	39	192	3.5	589.6	589.6	590.6	1.0
U	15,605	21	98	5.3	594.1	594.1	595.1	1.0
V	17,466	26	105	4.8	608.4	608.4	609.2	0.8

[1]Feet above confluence with Violette Stream.
[2]Elevation computed without consideration of backwater effects of Violette Stream.

The Town needs to explore the cost-to-benefit ratio for any planned road work.

Structural Measures

Structural measures generally include such options as dams, channel work, removal of channel restrictions, and dikes. They require in-depth engineering, environmental, and economic analyses beyond the scope of this study to determine feasibility. Structural measures tend to have significant environmental impacts. The following discussion considers each measure as it might apply to Van Buren.

1. Dams

Dams control flood flows by temporarily storing storm runoff in a reservoir and releasing it slowly after the storm has passed. Dams are expensive to build and have significant environmental impacts. Violette Brook Dam, a multi-purpose floodwater retarding dam, was constructed on Violette Brook in 1975. The dam was built with the assistance of the NRCS, through the Small Watershed Program, PL-566. A second dam was planned for Violette Stream but was not built due to prohibitive costs. The Violette Brook Dam is located in Cyr Plantation, just above the Van Buren town line, and is owned by the Van Buren Water District.

2. Channel Work

The purpose of channel work is to improve the flood carrying capacity and reduce flood damage along a given stream segment. This work can involve changing the alignment, widening, deepening, or lining the channel.

Major channel work of any kind would be difficult to permit in Maine because of severe environmental impacts. Historically, such efforts have resulted in controversy over the effects on fishery resources. Close coordination with interested agencies and groups would be required to determine the feasibility of this option.

3. Removal of Channel Restrictions

Bridges and culverts are the primary restrictions on the streams in Van Buren. Many are undersized or have inefficient inlet configurations and act as barriers to flood flows. The result is increased flow depths upstream of the bridge or culvert. As improvement funds become available, the Town and state should take action to increase bridge and culvert openings to increase discharge capacities.

Table 3, Summary of Discharges, provides peak discharge data at bridge and culvert locations. Table 4, Bridge and Culvert Data, compares flood elevations to the low chord and road overflow elevations. The data shows that improvements are necessary, particularly on the smaller streams. The Flood Profiles provide a graphical presentation of the effects of these restrictions on upstream flood elevations.

State and local road maintenance crews should remove trees, sediment, ice or other debris from all bridges and culverts before spring runoff. Particular attention should be paid to the smaller stream crossings that have a history of flood problems.

4. Dikes

A dike is an earthen embankment used as a barrier to protect structures from flood water. Any planned dike work must involve detailed modeling of flood flows to determine the effects of flood heights on existing structures in the floodplain.

GLOSSARY

CFS or cfs - Cubic feet per second. Used to describe the amount of flow passing a given point in a stream channel. One cubic foot per second is equivalent to approximately 7.5 gallons per second.

Channel - A natural or artificial watercourse with definite bed and banks to conduct and confine flowing water.

Cross Section - A graph or plot of ground elevation across a stream valley or a portion of it, usually along a line perpendicular to the stream or direction of flow.

Erosion - The group of processes whereby soil or rock material becomes loosened or dissolved and removed from any part of the earth's surface.

Flood - An overflow or inundation onto land areas not normally covered by water that are used or usable by people. Floods usually are characterized as temporarily inundating land areas which are adjacent to a body of water such as an ocean, lake, stream, or river.

Flood Crest - The maximum stage or elevation reached by the waters of a flood at any location.

Floodplain - The relatively flat area of lowlands adjoining the channel of a river, stream, watercourse, ocean, lake, or other body of standing water that has been or may be covered by floodwater.

Floodplain Management - The operation of a program intended to lessen the damaging effects of floods, maintain and enhance natural values, and make effective use of water and land resources within the floodplain. It is an attempt to balance values obtainable from use of floodplains with potential losses arising from such use. Floodplain management stresses consideration of a full range of the measures potentially useful in achieving its objectives.

Flood Hazard Area Map - A map showing the lateral extent of flooding. Maps in this report show the 100-, and 500-year floodplains.

Flood Profile - A graph that shows the relationship of water surface elevation to distance along the centerline of the channel. This report uses profiles to show the crest elevations of 10-, 50-, 100-, and 500-year floods.

Floodproofing - A combination of structural changes or adjustments to new or existing structures and facilities, their contents or their sites for the purpose of reducing or eliminating flood damages by protecting against structural failure, keeping water out, or reducing the effect of water entry.

Flood Warning - The issuance and dissemination of information about an imminent or current flood.

Floodway - That portion of the main stream channel plus any adjacent floodplain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights.

Floodway Fringe - That part of the floodplain that can be completely obstructed without increasing the 100-year flood elevation by more than 1.0 foot at any point.

Frequency - A statistical measure of how often a flood event of a given size or magnitude should, on the average, be equaled or exceeded.

Head - The height of water above any plane of reference.

Head Loss - The effect of obstructions, such as narrow bridge openings or buildings, that limit the area through which water must flow, raising the surface of the water upstream of the obstruction.

High Hazard Zone - An area, normally nearest the stream, where flooding may pose a significant risk to life and property. Areas having any one of the following conditions generally are considered high hazard:

- Areas where flood velocities exceed 5 feet per second (fps).
- Areas where flood depths are greater than 3 feet.
- Areas where the product of the velocity (in fps) and the depth (in feet) of the flood water exceeds seven.

Low Chord - The elevation at which a bridge girder first begins to reduce the flow area of the channel.

Low Hazard Zone - The area between the high hazard zone and the maximum extent of the 100-year frequency flood where the potential for loss of life and property damage is low.

Natural Values of Floodplains - The desirable qualities of, or functions served by, floodplains including, but not limited to: water resources values (e.g. -- moderation of floods, water quality maintenance, and ground water recharge); living resource values (e.g. -- fish, wildlife, plant resources, and habitat); cultural resource values (e.g. -- open space, natural beauty, scientific study, outdoor education, and recreation); and cultivated resources values (e.g. -- agricultural, aquacultural, and forestry).

NGVD - National Geodetic Vertical Datum, formerly Mean Sea Level (MSL) 1929.

Nonstructural Measures - All floodplain management measures except structural flood control works. Examples of nonstructural measures are flood warning and preparedness systems, relocation, floodproofing, regulation, land acquisition, and public investment policy.

Relocation - Moving a building from a flood prone area by physically placing it on a vehicle and transporting it from the floodplain.

Road Overflow - The elevation of the point at which water first starts to flow over a road.

Shoreland Areas - Land within 250 feet of the normal high water mark of any pond, river, or salt water body, including a major portion of the floodplain.

Station - Distance in feet along the centerline of the existing channel, increasing in an upstream direction.

Structural Measure - Flood control works such as dams and reservoirs, dikes and floodwalls, channel alterations, and diversion channels which are designed to keep water away from specific developments or populated areas, or to reduce flooding in such areas.

Wetland - Areas that have a predominance of hydric soils and that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions.

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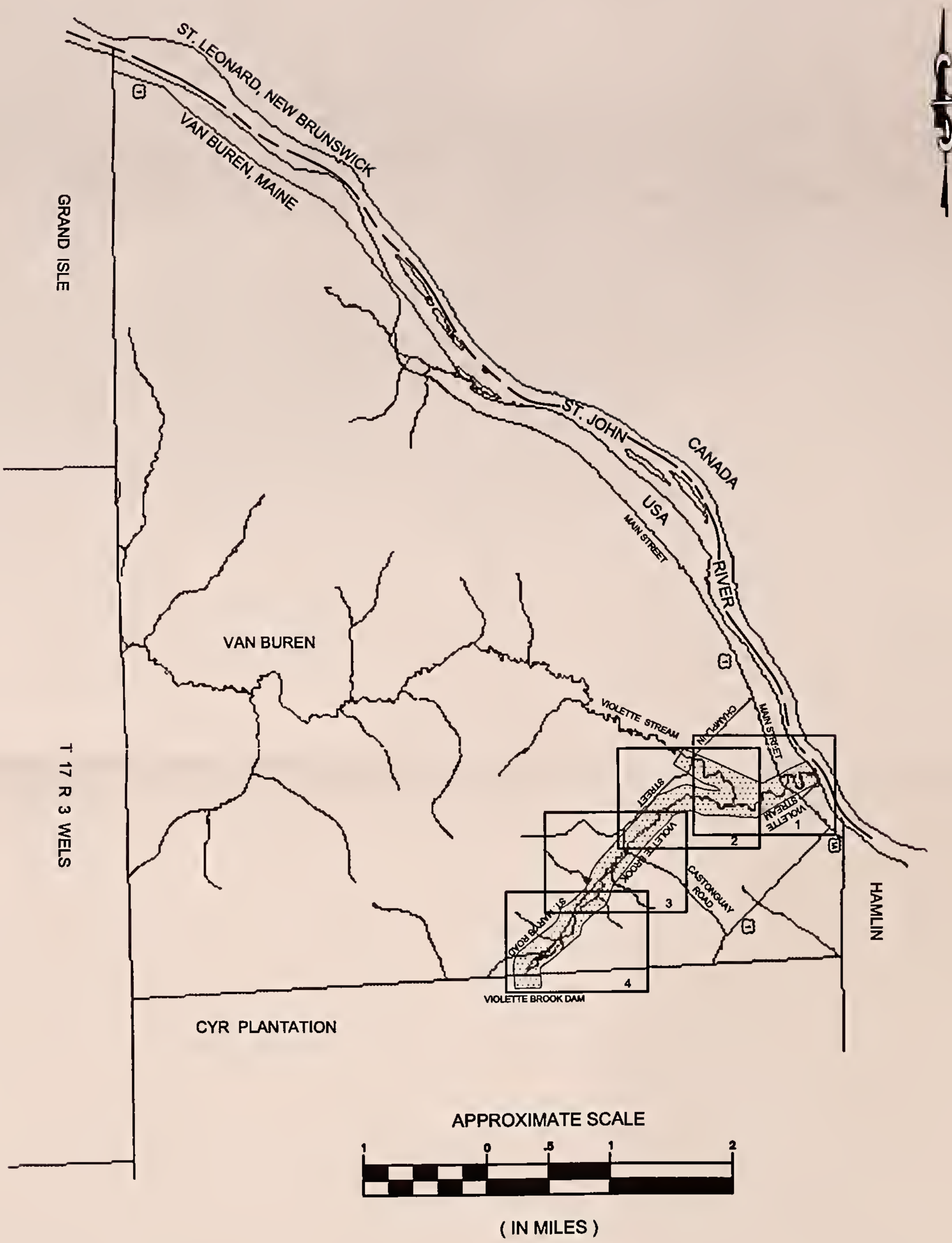
8. U.S. Department of the Interior, Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet -- Lille, Maine, 1986; Van Buren, Maine, 1986; and Violette Brook, Maine, 1986.

Civil Rights Impact Analysis

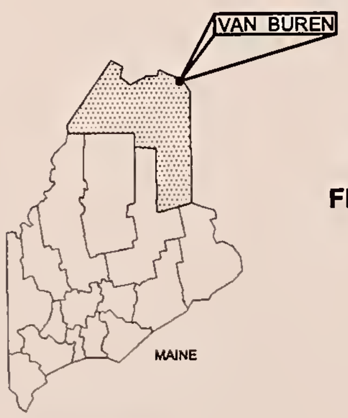
The NRCS official responsible for the civil rights impact analysis for this FPMS has determined that civil rights impacts have been identified and adequately addressed. No protected groups will be negatively or disproportionately impacted as a result of recommendations included in this study.

APPENDIX A
FLOOD HAZARD AREA MAPS



1 SHEET COVERAGE

STREAM REACH STUDIED



LOCATION MAP

INDEX TO MAP SHEETS
VAN BUREN
FLOODPLAIN MANAGEMENT STUDY
AROOSTOOK COUNTY, MAINE

SOURCE:

BASE COMPILED FROM 1:24,000 USGS QUADRANGLES AND INFORMATION FROM NRCS FIELD PERSONNEL.

FEBRUARY 2000

1988 USDA/NRCS AERIAL PHOTOGRAPHY

LEGEND

452 〰〰	100-Year Flood Elevation	(A)	Valley Section Location
— — —	Floodway Boundary	▲	Elevation Reference Marks

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT. THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

0 500 1000
APPROXIMATE SCALE IN FEET

A - 1

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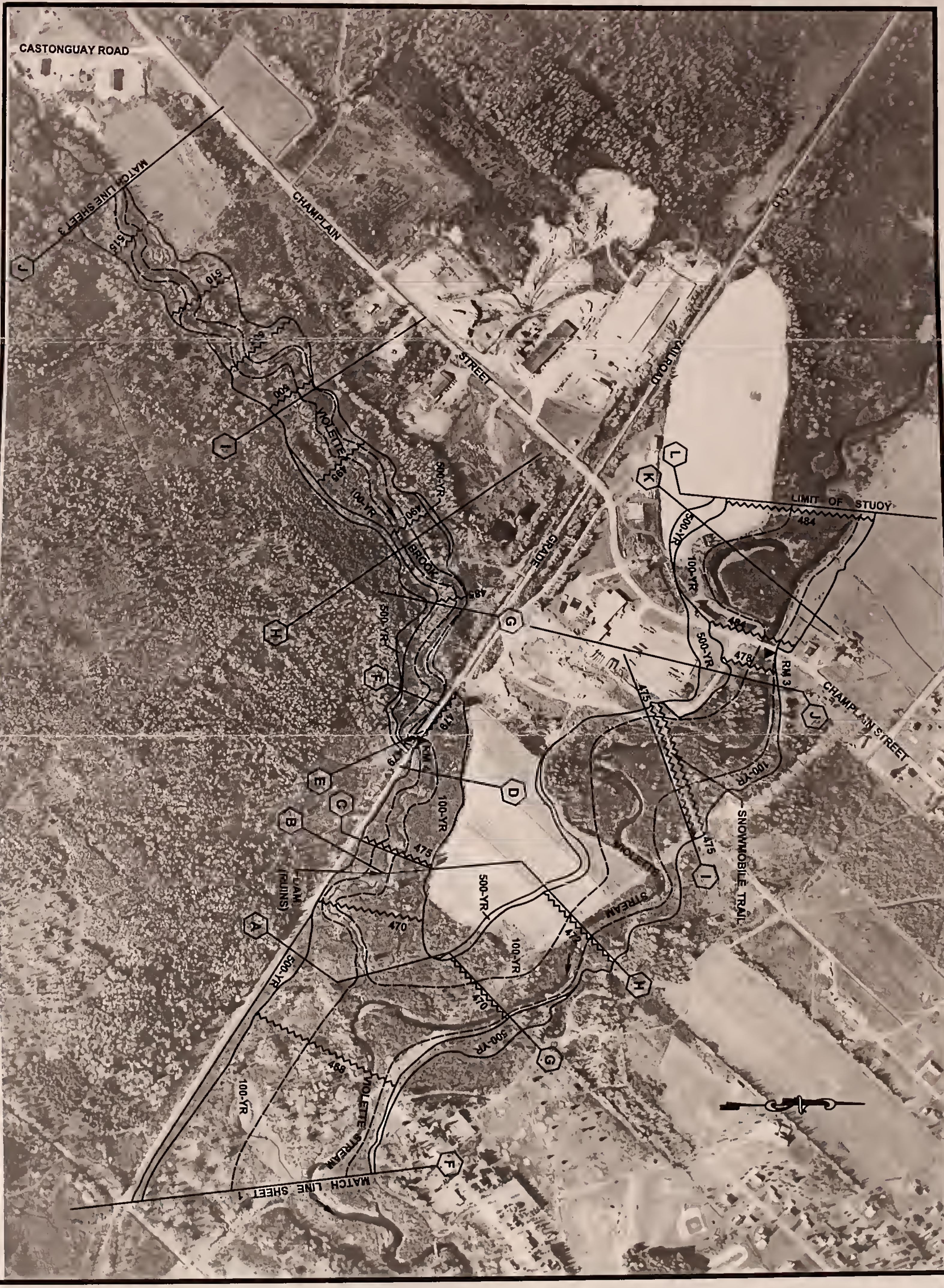
FLOOD HAZARD AREA MAP

VIOLETTE STREAM



1996 USDANRCS AERIAL PHOTOGRAPHY

LEGEND

468 100-Year Flood Elevation

Floodway Boundary

(F) Vellay Section Location

▲ Elevation Rafarence Merks

NOTE:
LIMITS OF FLOOOING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUNO OUE TO INHERENT AERIAL PHOTOGRAPHIC OISPLACEMENT. THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

0 500 1000
APPROXIMATE SCALE IN FEET

A - 2

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FLOOD HAZARD AREA MAP

VIOLETTE BROOK AND VIOLETTE STREAM

1998 USDA/NRCS AERIAL PHOTOGRAPHY

LEGEND

452 — 100-Year Flood Elevation

Floodway Boundary

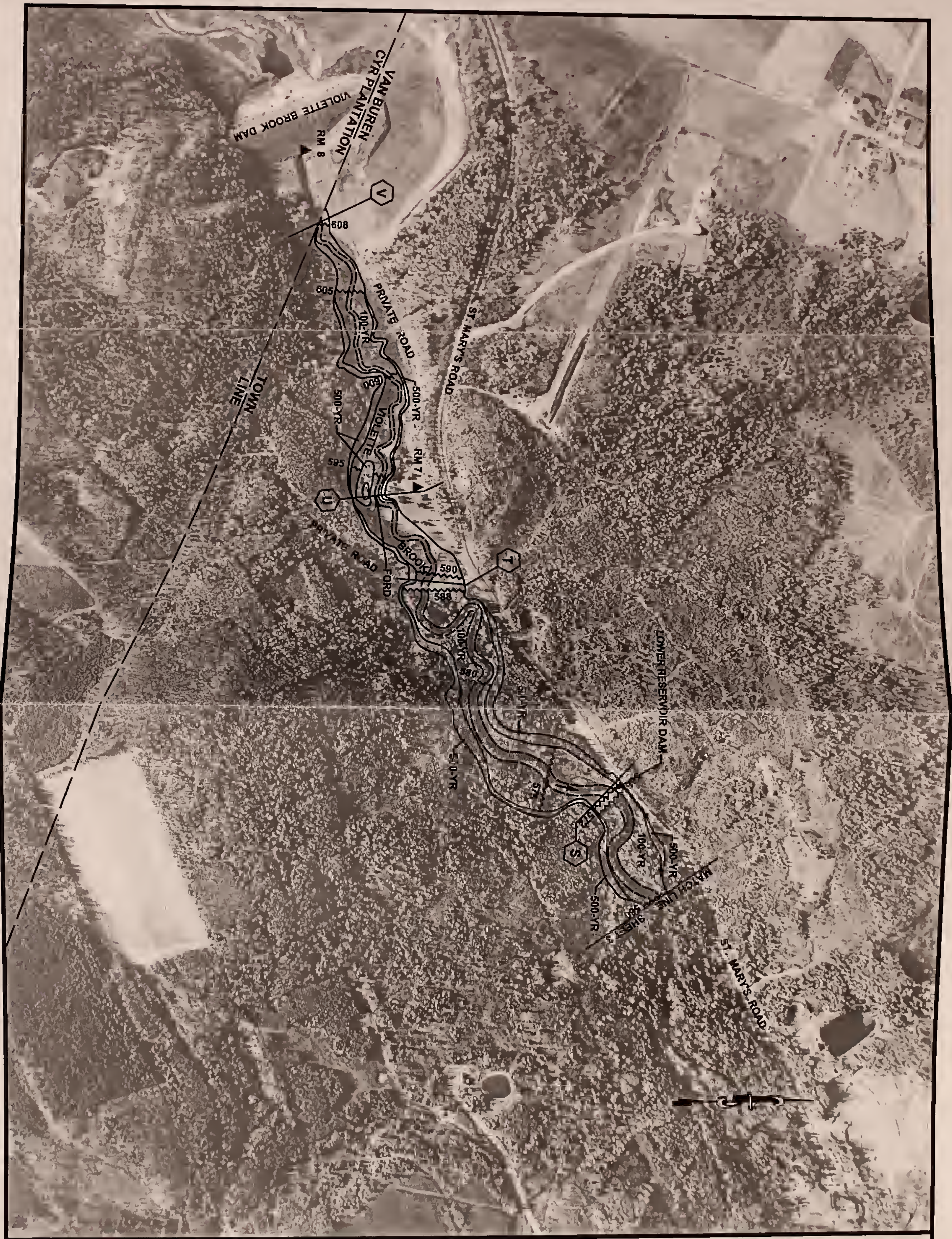
(J) Valley Section Location

▲ Elevation Reference Marks

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT. THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

0 500 1000
APPROXIMATE SCALE IN FEET

A - 3	U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE TOWN OF VAN BUREN FLOODPLAIN MANAGEMENT STUDY AROOSTOOK COUNTY, MAINE	FLOOD HAZARD AREA MAP VIOLETTE BROOK



1998 USDA/NRCS AERIAL PHOTOGRAPHY

LEGEND

560 〰〰	100-Yaar Flood Elevation	(S)—	Valley Section Location
— — —	Floodway Boundary	▲	Elevation Raference Marks

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT. THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

0 500 1000
APPROXIMATE SCALE IN FEET

A-4

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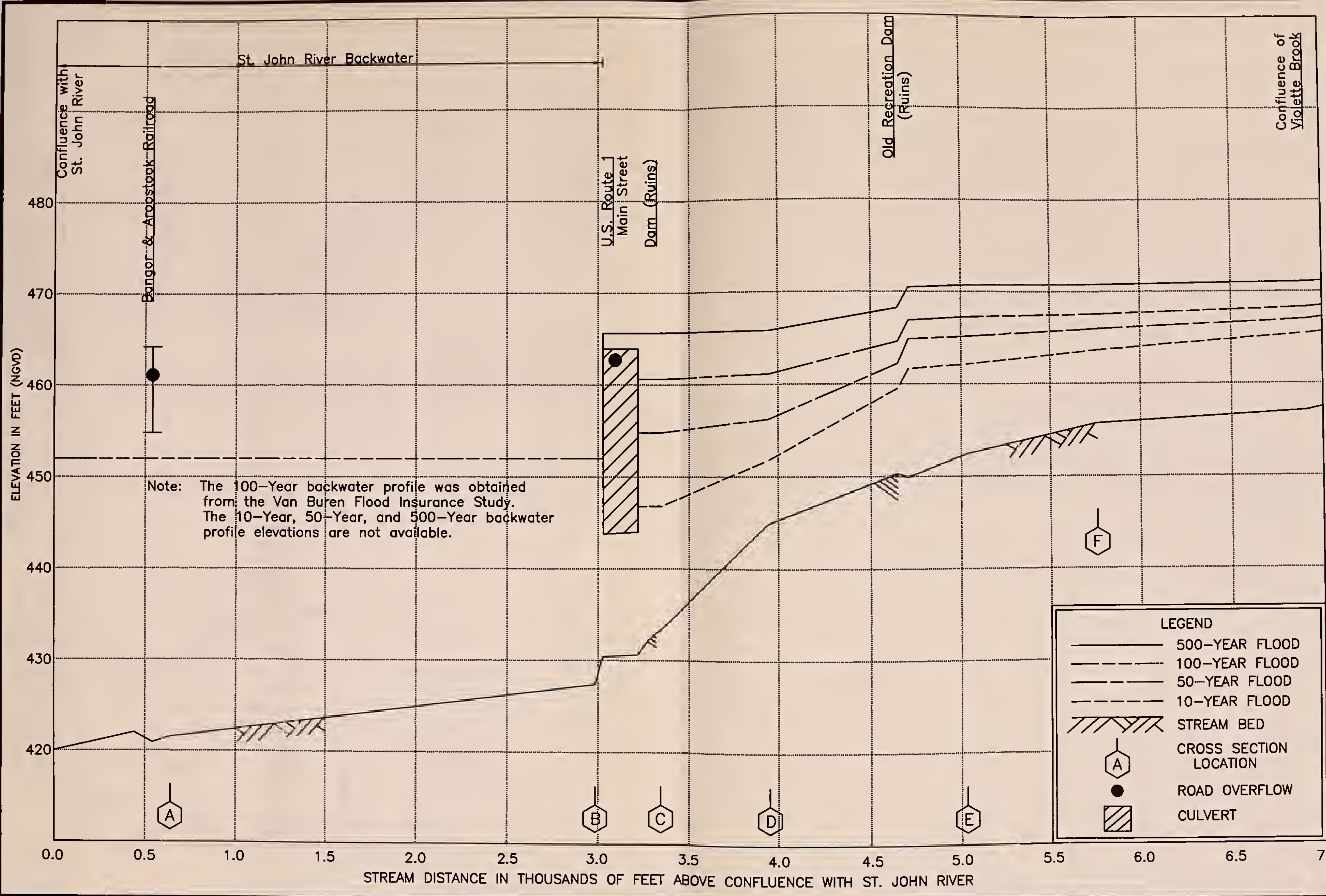
AROOSTOOK COUNTY, MAINE

FLOOD HAZARD AREA MAP

VIOLETTE BROOK

APPENDIX B
FLOOD PROFILES



FLOOD PROFILES VIOLETTE STREAM

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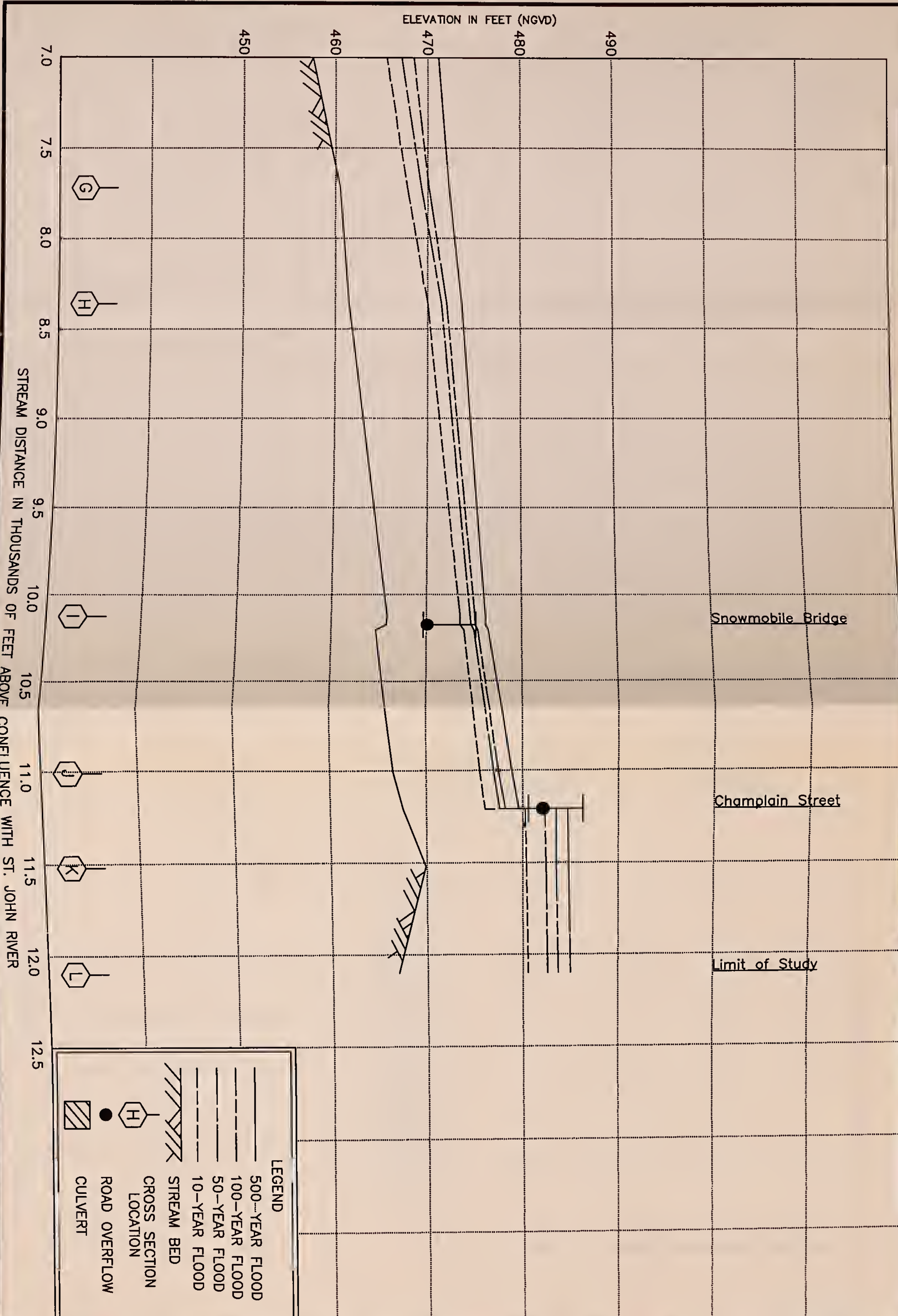
TOWN OF VAN BUREN
FLOODPLAIN MANAGEMENT STUDY
AROOSTOOK COUNTY, MAINE



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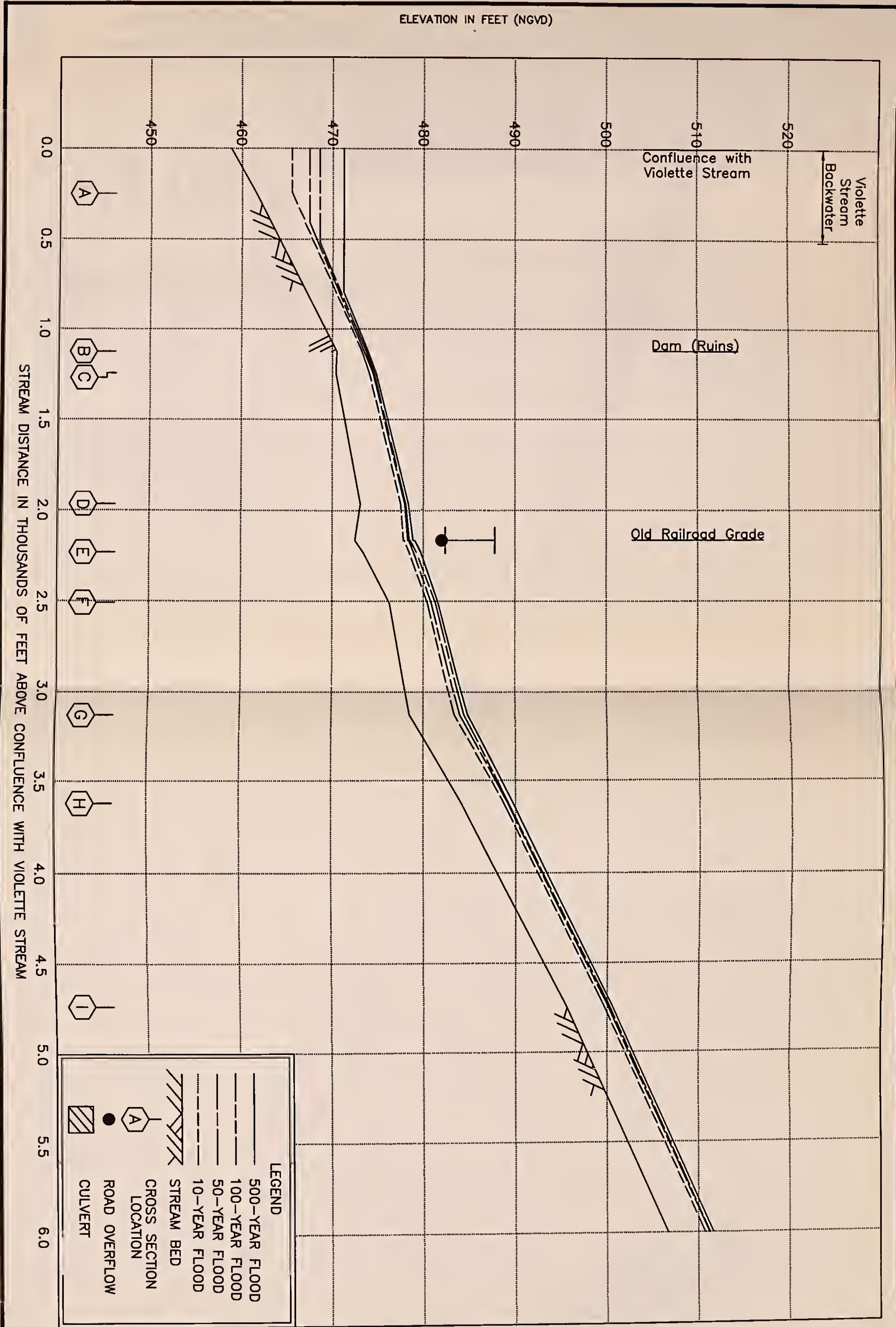
AROOSTOOK COUNTY, MAINE

FLOOD PROFILES
VIOLETTE STREAM

B-2



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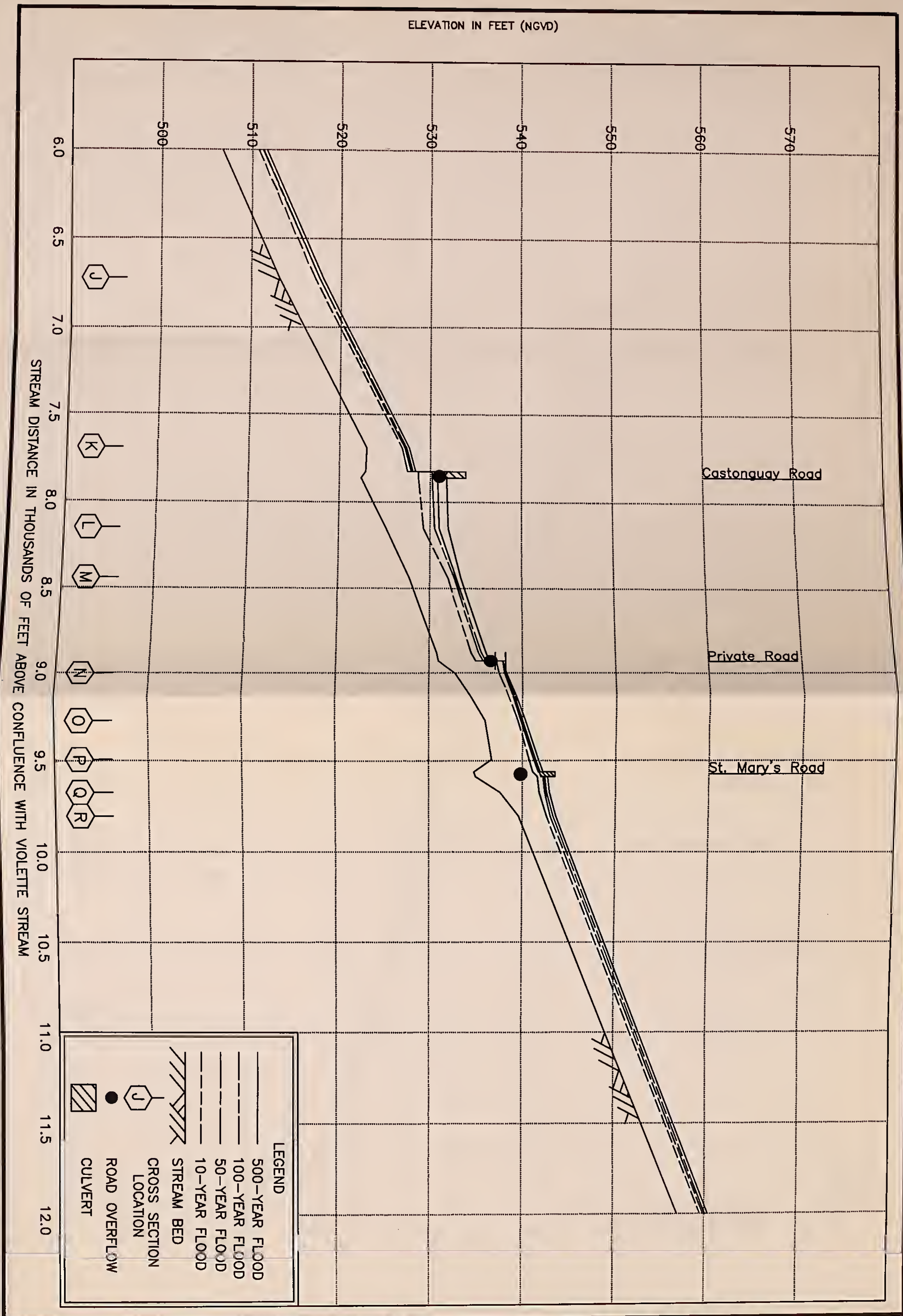
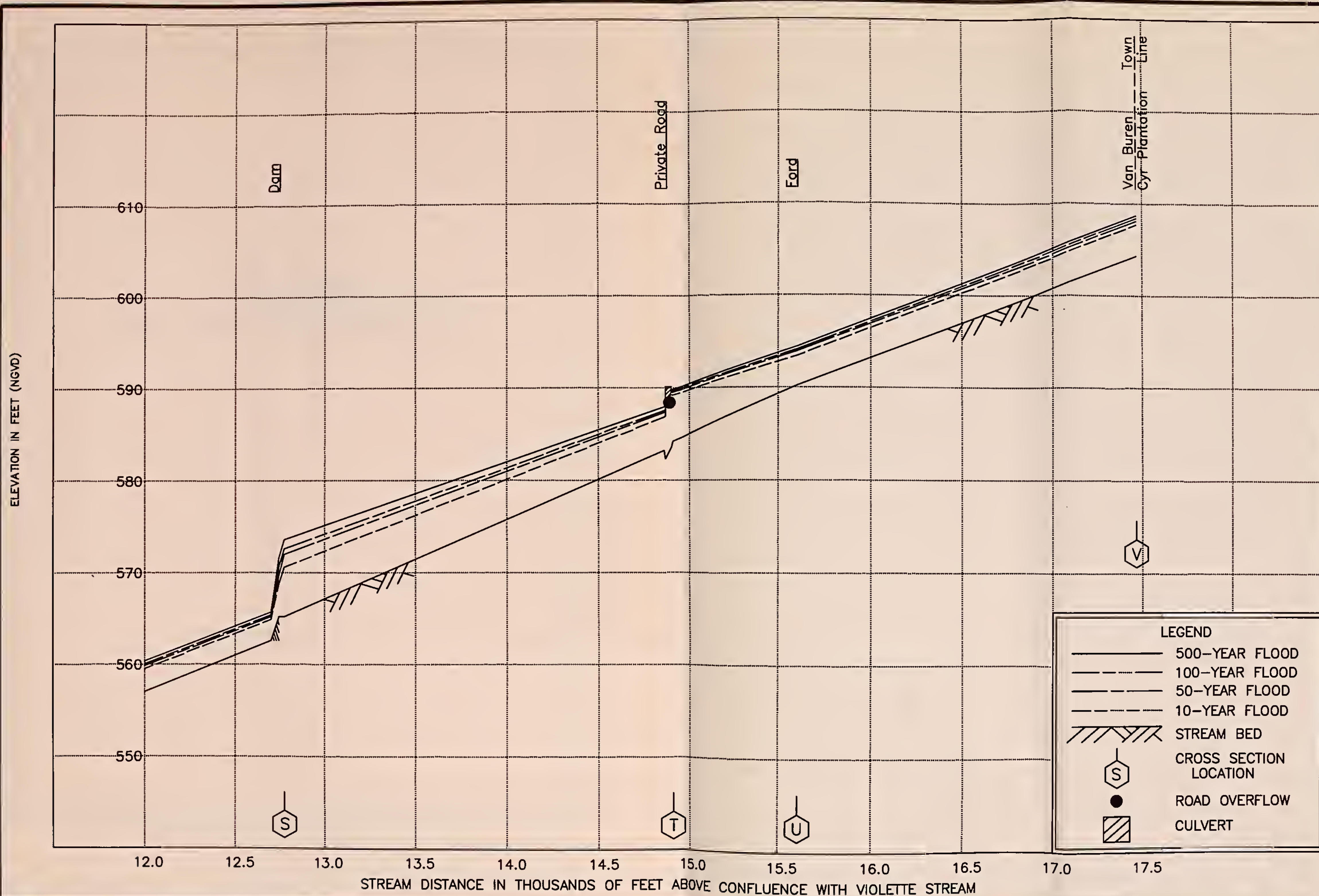
FLOOD PROFILES
VIOLETTE BROOK



B-4	U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE **TOWN OF VAN BUREN** **FLOODPLAIN MANAGEMENT STUDY** AROOSTOOK COUNTY, MAINE	**FLOOD PROFILES** **VIOLETTE BROOK**



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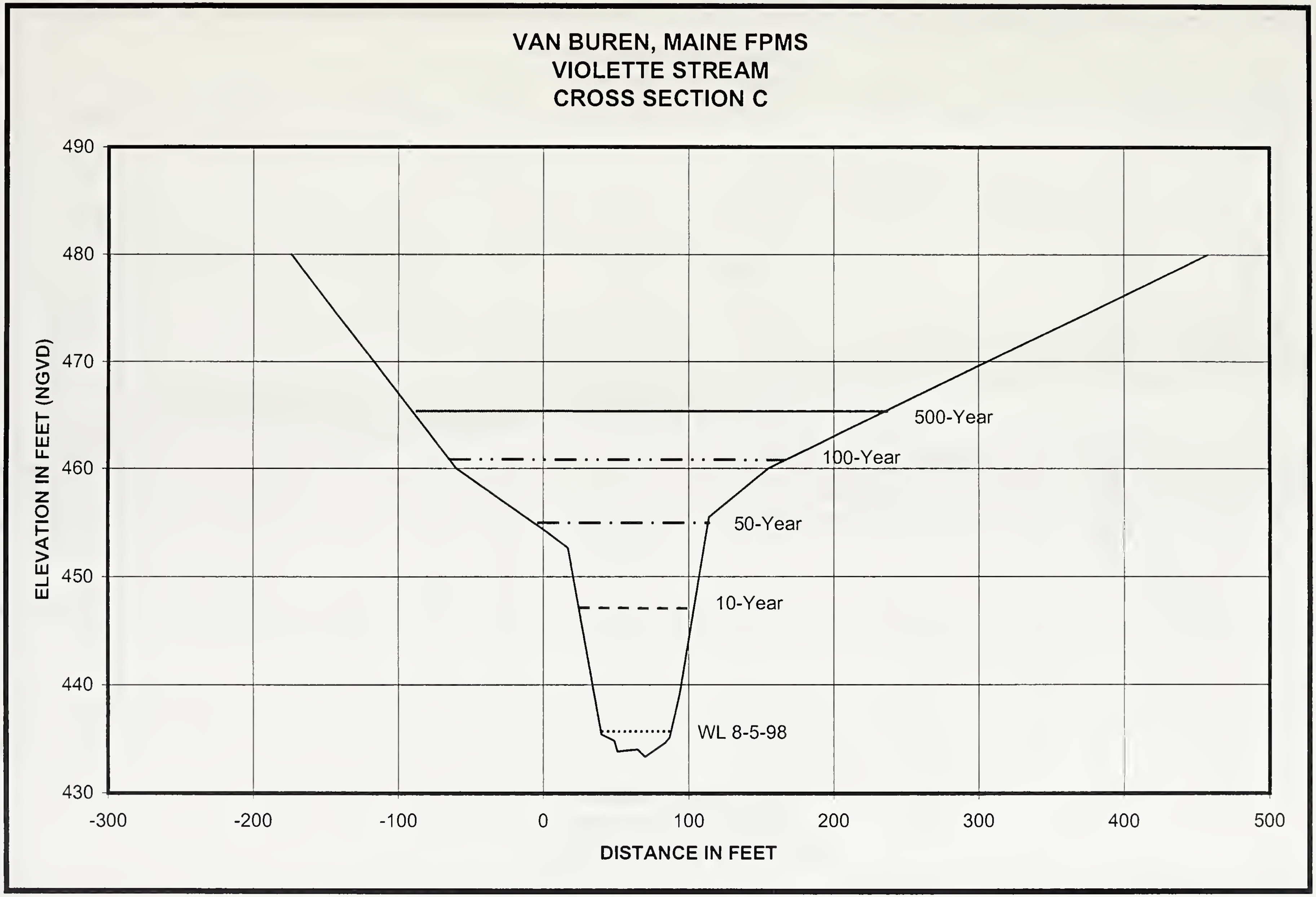
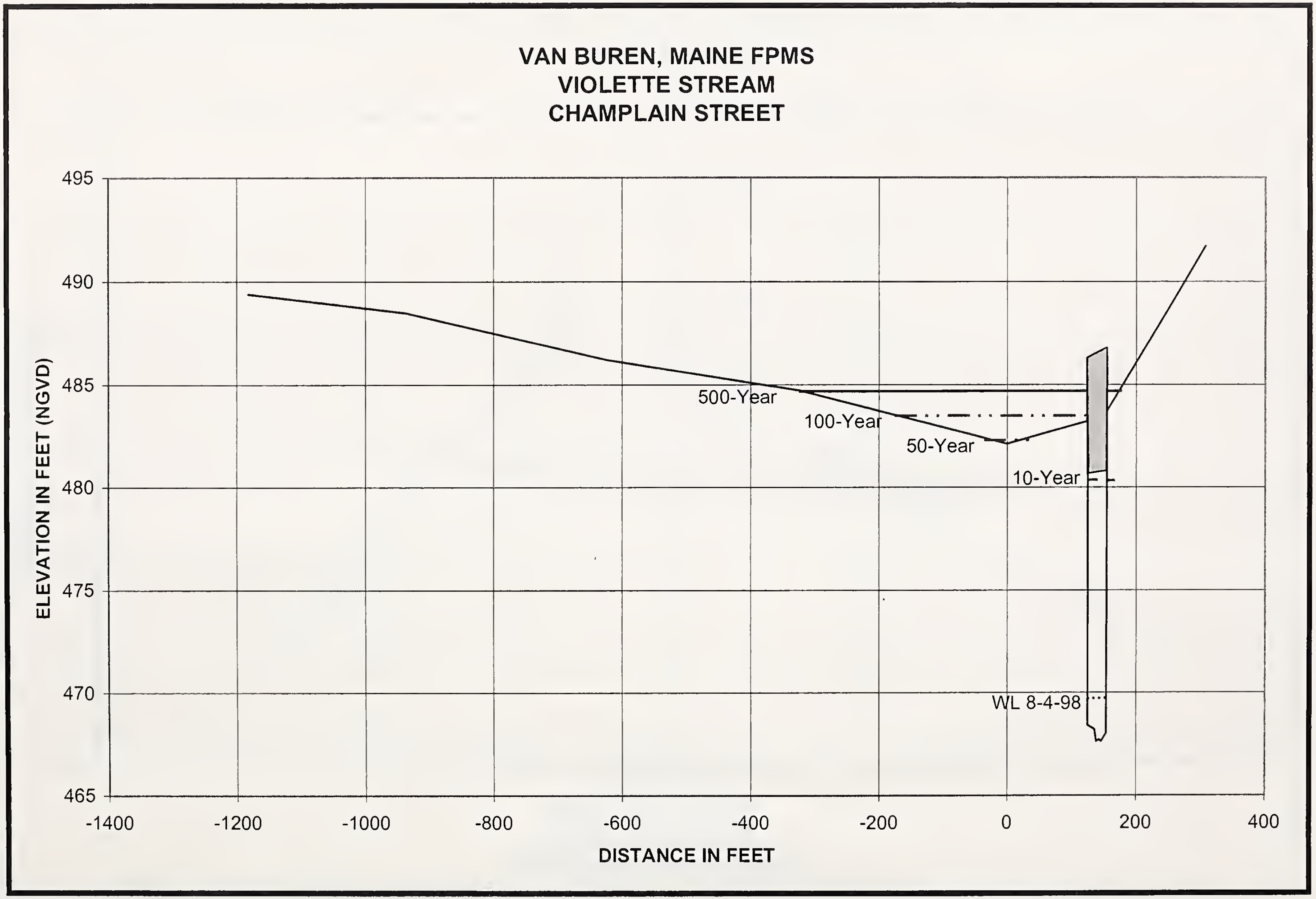
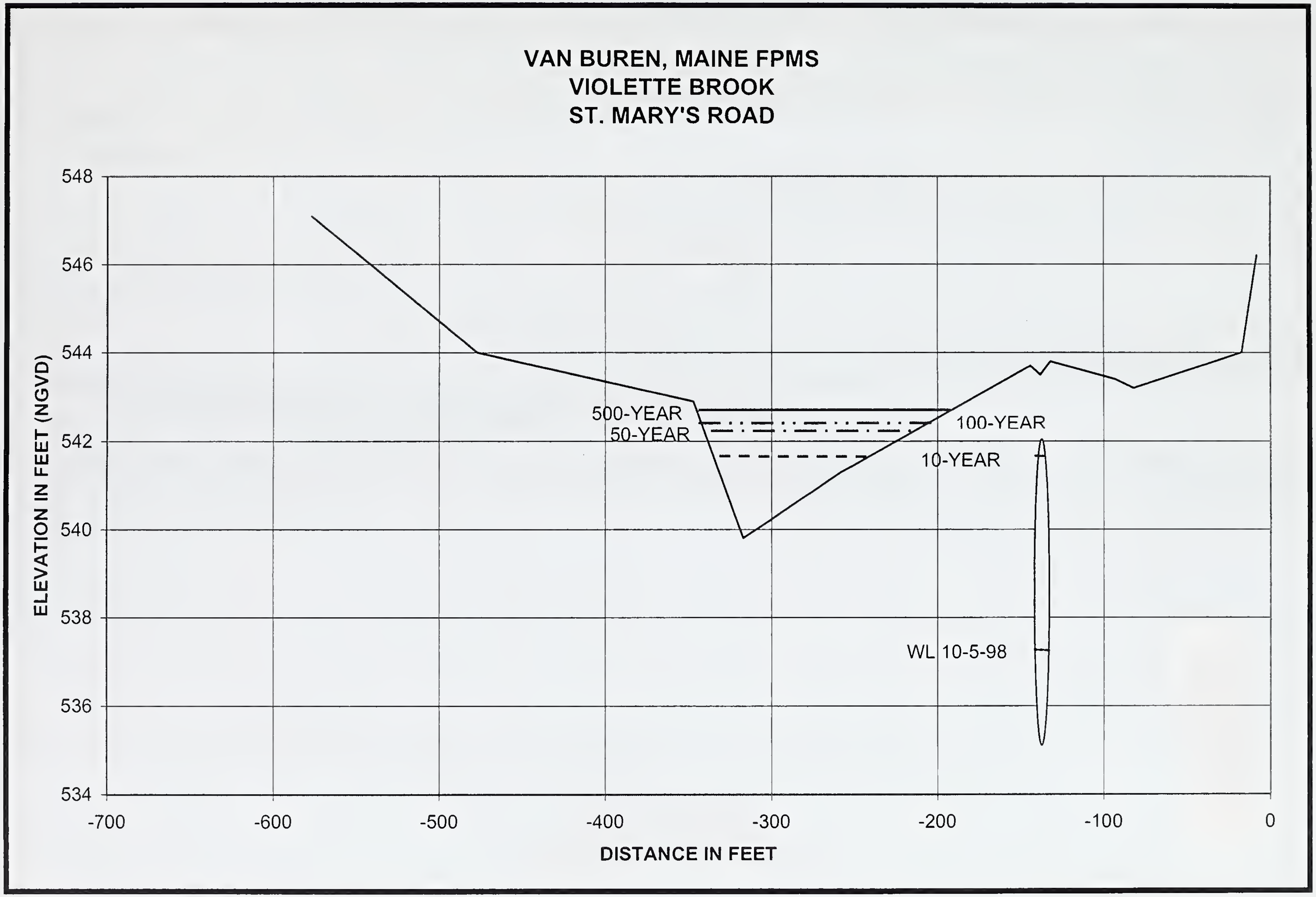
AROOSTOOK COUNTY, MAINE

FLOOD PROFILES
VIOLETTE BROOK

APPENDIX C
SELECTED CROSS SECTIONS


VAN BUREN, MAINE FPMS
VIOLETTE STREAM
CROSS SECTION C
ELEVATION IN FEET (NGVD)
490
480
470
460
450
440
430
500-Year
100-Year
50-Year
10-Year
WL 8-5-98
-300
-200
-100
0
100
200
300
400
500
DISTANCE IN FEET


VAN BUREN, MAINE FPMS
VIOLETTE STREAM
CHAMPLAIN STREET
ELEVATION IN FEET (NGVD)
495
490
485
480
475
470
465
-1400
-1200
-1000
-800
-600
-400
-200
0
200
400
DISTANCE IN FEET
500-Year
100-Year
50-Year
10-Year
WL 8-4-98


VAN BUREN, MAINE FPMS
VIOLETTE BROOK
ST. MARY'S ROAD
548
546
544
542
540
538
536
534
ELEVATION IN FEET (NGVD)
-700
-600
-500
-400
-300
-200
-100
0
DISTANCE IN FEET
500-YEAR
50-YEAR
100-YEAR
10-YEAR
WL 10-5-98

VAN BUREN, MAINE FPMS
VIOLETTE BROOK
CROSS SECTION U